PATENT CLAIMS

1. A device for guiding at least two flow media having different pressures, comprising a shaft or similar force-transmitting member and a pressure-insulating element such as a housing surrounding the shaft or similar, characterized in that areas (90, 90_a; 96; 98) which lie next to one another in the direction of the axis are defined between the force-transmitting member (10) and the pressure-insulating element by means of sealing elements (70, 70_a), wherein at least one of the sealing elements (70, 70_a) is designed to be leakage-free and two areas (90, 90_a; 98) for fluids (A, B) having different pressures flank an area (96) for an auxiliary liquid (H) and the latter area is subdivided by means of a device (100) into two partial areas (96_a, 96_b) for two different pressure regions.

2. The device as claimed in claim 1, characterized by a magnetofluidic sealing element (70, 70_a) for delimiting the area (96) for the auxiliary liquid (H).

3. The device as claimed in claim 1 or 2, characterized in that a conveying medium is assigned to the higher-pressure area (90_a) and ambient air is assigned to the low-pressure area (98).

4. The device as claimed in claim 2, characterized in that the auxiliary liquid (H) is a carrier oil of the magnetofluid assigned to the sealing element (70, 70_a), optionally a silicone oil.

5. The device as claimed in claim 1 or 3, characterized in that the area (96) for the auxiliary liquid (H) has two connections (33), one of which is designed to generate a vacuum and the other of which is designed as a passage for the auxiliary liquid (H).

6. The device as claimed in claim 1 or 3, characterized in that the partial area (96_a) for the higher pressure of the auxiliary liquid (H) is assigned to the area (90_a) for the fluid (A) having a higher pressure (Figs. 18 to 20).

7. The device as claimed in any of claims 1 to 6, characterized by means for generating a pressure difference between the partial areas (96_a, 96_b), wherein the means are preferably arranged within the partial areas (96_a, 96_b).

8. The device as claimed in any of claims 1 to 7, characterized by geometric parts which can be moved relative to one another and are assigned to the pressure-insulating element and to the force-transmitting member (10), said parts forming a conveying device for the auxiliary liquid (H) so as to generate a pressure difference.

9. The device as claimed in any of claims 1 to 8, characterized in that the device which divides the area (96) for the auxiliary liquid (H) is a conveying device (100).

10. The device as claimed in any of claims 1 to 9, characterized in that the pressure difference which can be generated corresponds at least to the maximum pressure difference which occurs between the fluids (A, B).

11. The device as claimed in claim 10, characterized in that means are provided via which the pressure difference between the maximum pressure of the auxiliary liquid and the pressure of the fluid having the higher pressure can be adjusted to zero, preferably members for adjusting the power of the means which generate the pressure difference.

12. The device as claimed in claim 11, characterized by members (97, 99) for adjusting a return flow from the higher-pressure partial area (96_a) of the auxiliary liquid (H) to the low-pressure partial area (96_b), wherein a line (99) with a valve-type overflow device (97) is optionally provided between the partial areas (96_a, 96_b) for the auxiliary liquid (H).

13. The device as claimed in any of claims 1 to 12, characterized in that the volume of at least the area (96) for the auxiliary liquid (H) is designed to be variable.

14. The device as claimed in any of claims 6 to 13, characterized in that at least the partial area (96_b) for the low-pressure region of the auxiliary liquid (H) is configured with a variable volume.

15. The device as claimed in claim 1, characterized by membrane-type sealing elements for delimiting the area (96) for the auxiliary liquid (H).

16. The device as claimed in any of claims 2 to 15, characterized in that a magnetofluidic sealing element (70, 70_a) extends on either side of the area (96) for the auxiliary liquid (H) between the force-transmitting member (12) and the pressure-insulating element (24).

17. The device as claimed in any of claims 1 to 16, characterized in that the sealing element (70, 70_a) contains at least one permanent magnet (74) in a ring (76) and also a magnetofluid (75) assigned to the force-transmitting member or to the shaft (10) at an annular gap (77).

18. The device as claimed in claim 17, characterized in that the permanent magnet (74) forms part of a magnetic seal (70) which forms the sealing element, said magnetic

seal surrounding the shaft (10) with the ring (76), wherein the magnetic field of the annular permanent magnet (70) is optionally concentrated on the annular gap (77) by means of associated pole shoes (73).

19. The device as claimed in claim 17 or 18, characterized by permanent magnets (70) magnetized in the direction of the axis on the high-pressure side in a carrier ring or lock ring (60) made of non-magnetic material, or by at least two concentric magnetic seals (70, 70_a), the cross sections of which are separated by at least one axis-parallel spacer ring (79).

20. The device as claimed in claim 19, characterized in that a bellows (68) bears against the lock ring (60), said bellows bearing on the other side against the pressure-carrying element.

21. The device as claimed in claim 20, characterized in that the bellows (68) is made of metallic material and is preferably surrounded by a retaining ring (56) on its radial outer side, and/or is supported against a front ring (54) fixed to the housing bushing (26).

22. The device as claimed in any of claims 19 to 21, characterized in that the lock ring (60) contains at least one sealing disk (80) as part of a mechanical sealing system which comprises at least two sealing disks (80, 80_a) with a central opening (82), wherein the sealing disk (80, 80_a) is optionally molded from silicon carbide.

23. The device as claimed in claim 22, characterized in that the sealing disks (80, 80_a) bear against one another with contact faces (84), wherein optionally at least one sealing disk (80_a) has spiral grooves or depressions (86) of small depth (c) which run in a curved manner in the contact face (84) from the disk edge (81) toward the disk center, said grooves or depressions ending at a distance

from the central opening (82) and being covered by the contact face of the other sealing disk (80).

24. The device as claimed in any of claims 1 to 23, characterized in that at least one shaft sleeve (12), which surrounds the shaft (10), and a housing bushing (26) which is coaxial thereto are in each case made of a non-magnetic material, and at least two of the magnetofluidic sealing elements (70, 70_a) which surround the shaft are provided between said shaft sleeve and said housing bushing.

25. The device as claimed in claim 24, characterized in that O-rings (20) provide static sealing of the shaft sleeve (12) with respect to the shaft (12) and of the housing bushing (26) with respect to the housing.

26. The device as claimed in claim 24 or 25, characterized in that the force-transmitting member or the shaft sleeve (12) and the pressure-insulating element or the housing bushing (26) are held at a defined axial spacing and such that they can rotate concentrically by means of roller bearings (52) arranged radially with respect to the longitudinal axis (M_1) of the shaft sleeve, in particular by means of a double angular contact ball bearing.

27. The device as claimed in claims 22 and 26, characterized in that the roller bearing (52) bears against an outer ring (16) of the shaft sleeve (12), with one of the sealing disks (80_a) made of silicon carbide being assigned to the other side thereof.

28. The device as claimed in claim 22 or 27, characterized in that one sealing disk (80_a) is mounted in a section (51) of the annular space (50) which widens in steps in the axial direction away from the outer ring

(16), said section being assigned the lock ring (60) comprising the other sealing disk (80).

29. The device as claimed in any of claims 2 to 23, characterized by a shaft (10) made of ferromagnetic material.

30. The device as claimed in any of claims 22 to 23, characterized in that a radial gap (17) runs between the outer face of the sealing disk (80) and the adjacent lock ring (60).

31. The device as claimed in claim 30, characterized in that the radial gap (17) is adjoined on one side by an axial annular gap (77) between the shaft (10) and the sealing elements (70) and on the other side by an axial annular gap (13) which passes below the adjacent sealing disk (80), and/or in that a stop face (69) is provided at the radially outer end of the radial gap (17), said stop face being adjoined by an outer annular gap (21) which runs in an axis-parallel manner (Fig. 5).

32. The device as claimed in any of claims 28 to 31, characterized in that the sealing disk (80) is connected to the center wall (63) of the lock ring (60) by means of at least one axis-parallel drive pin (67).

33. The device as claimed in any of claims 1 to 32, characterized in that a chamber (90) which is partially filled with a gas (G) and is provided with a sealing gap (92) is arranged in front of the side acted upon by a fluid.

34. The device as claimed in claim 33, characterized in that the chamber (90) which is partially filled with a gas (G) and is provided with a sealing gap (92) is arranged in front of the magnetofluidic sealing element (70) on the carrier ring or lock ring (60) (Fig. 17).

35. The device as claimed in claim 33 or 34, characterized in that the width (q_3) of the sealing gap (92) is greater than the width (q_2) of the sealing element (70) of the sealing gap (77) on the carrier ring or lock ring (60) with respect to the shaft (10), wherein optionally the ratio between the width (q_2) of the sealing gap (77), the width (q_3) of the sealing gap (77) of the chamber (90) and also the internal outer diameter (f_2) of the chamber (90) or the outer chamber wall (94) is 1 to 1.2 to 1.5.

36. The device as claimed in any of claims 33 to 35, characterized in that the cross section of the chamber (90) is widened toward the outside (Fig. 17).

37. The device as claimed in any of claims 33 to 36, characterized in that an auxiliary connection for inert gas is assigned to the chamber (90).

38. A method for guiding at least two flow media having different pressures, comprising a shaft or similar force-transmitting member and a pressure-insulating element such as a housing surrounding the shaft or similar, in particular using a device as claimed in at least one of the preceding claims, characterized in that, between the force-transmitting member (10) and the pressure-insulating element, fluids (A, B) having different pressures are held in areas (90, 90_a; 98) which are in each case delimited by a sealing element (70, 70_a), and between said areas at least one auxiliary liquid (H) is held in an area (96), wherein two different pressure regions are established in the latter and the partial area for the higher pressure of the auxiliary liquid (H) is assigned to the area (90_a) for the fluid (A) having a higher pressure.

39. The method as claimed in claim 38, characterized in that the area (96) for the auxiliary liquid (H) is hermetically sealed by means of magnetofluidic sealing elements (70, 70_a) on either side with respect to the areas (90, 90_a; 98) for the fluids (A, B).

40. The method as claimed in claim 38 or 39, characterized in that the area (96) for the auxiliary liquid (H) is acted upon by a vacuum in front of said liquid.

41. The method as claimed in any of claims 38 to 40, characterized in that a conveying medium is assigned to the higher-pressure area (90, 90_a) and ambient air is assigned to the low-pressure area (98).

42. The method as claimed in any of claims 38 to 41, characterized in that the pressure difference which can be generated corresponds at least to the maximum pressure difference which occurs between the fluids (A, B), or in that the power of the means which generate the pressure difference is adjusted.

43. The method as claimed in any of claims 38 to 42, characterized in that a return flow from the higher-pressure partial area (96_a) of the auxiliary liquid (H) to the low-pressure partial area (96_b) is adjusted.

44. The method as claimed in any of claims 38 to 43, characterized in that the pressure difference within the auxiliary liquid (H) is generated by the relative movement of geometric elements which are assigned to the shaft (10) on the one hand and to the pressure-insulating element on the other hand and form a conveying device (100).

45. The method as claimed in any of claims 38 to 44, characterized in that a conveying effect for the

auxiliary liquid (H) is created by means of sealing disks (80, 80_a) which between them delimit spiral grooves or depressions (86), wherein optionally the conveying effect of the sealing disks (80, 80_a) is increased by increasing the pressure thereof and also the distance thereof with respect to one another.

46. The method as claimed in any of claims 38 to 45, characterized in that, in a chamber (90) which is arranged in front of the sealing element (70) and contains a gas, the gas volume during operation collects concentrically around the shaft (10) in the region of the sealing gap (77) between the sealing element and said shaft, and is compressed by means of the operating pressure.